# Sheet 6

1. Draw the Bode diagram of the following transfer functions, Determine the phase margin and gain margin:

   a) $GH(z) = \dfrac{0.5(z+0.1)}{(z-0.7)(z-0.9)}$

   b) $GH(z) = \dfrac{0.5(z-1)}{(z-0.1)(z-0.8)}$

   c) $GH(z) = \dfrac{0.5(z+0.76)}{(z-1)(z-0.45)}$

2. For the following systems:

   a) $y(k+2) + 6y(k+1) + 5y(k) = 2r(k)$

   b) $y(k+2) + 6y(k+1) + 5y(k) = 3r(k+2) + r(k+1) + 2r(k)$

   c) $\dfrac{Y(z)}{R(z)} = \dfrac{z^2+2}{z^3+3z^2-4z+2}$

   d) $\dfrac{Y(z)}{R(z)} = \dfrac{z^3+z^2-3z-4}{z^4-2z^3+2z^2+5z+4}$

   i.   Obtain the controllable canonical state-space form.
   ii.  Obtain the observable canonical state-space form.
   iii. Draw the state diagram for these forms.

3. For the following systems:

   a) $y(k+2) + 6y(k+1) + 5y(k) = 2r(k)$

   b) $y(k+2) + 6y(k+1) + 5y(k) = 3r(k+2) + r(k+1) + 2r(k)$

   c) $\dfrac{Y(z)}{R(z)} = \dfrac{z-0.5}{z(z+0.5)(z+0.25)}$

   d) $\dfrac{Y(z)}{R(z)} = \dfrac{z-0.5}{(z+0.5)^2(z+1)}$

   i.  Obtain the diagonal state-space form.
   ii. Draw the state diagram for the obtained form.

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